A description of the knowledge and attitudes towards bystander CPR amongst participants in a community outreach initiative in Cape Town

By

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Research assignment submitted in partial fulfilment of the requirements for the degree of Masters of Medicine in the Faculty of Medicine and Health Sciences

at Stellenbosch University

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Declaration:

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_____ 2020/11/10

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Contents

Abbreviations:

AED	-	Automated External Defibrillator
AHA	-	American Heart Association
BLS	-	Basic Life Support
COCPR	-	Compression-only Cardiopulmonary Resuscitation
CPR	-	Cardiopulmonary Resuscitation
EMS	-	Emergency Medical Services
HIC	-	High Income Country
IHCA	-	In-hospital Cardiac Arrest
LMIC	-	Low and Middle Income Countries
OHCA	-	Out-of-hospital Cardiac Arrest
UAE	-	United Arab Emirates
USA	-	United Stated of America
WHO	-	World Health Organization

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PART A: LITERATURE REVIEW

Introduction:

Cardiac arrest is defined as the loss of mechanical activity of the heart, as witnessed by the absence of any signs of circulatory function, such as a pulse and blood pressure.[1] Sudden cardiac death is further described by the World Health Organization (WHO) as any death from a presumed cardiac origin, occurring in a patient that was previously well but demises within an hour after onset of symptoms, or any death that was unexpected, unexplained and unwitnessed in a patient that was symptom free 24 hours previously.[1]

There are a multitude of reasons why people suffer sudden cardiac arrest, including but not limited to primary cardiac events, pulmonary embolism, respiratory failure, trauma and cerebral events.[1] Risk factors for primary cardiac events can be divided into fixed and modifiable factors.[1] Fixed factors include gender, increasing age, ethnicity and polygenetic risks related to accelerated atherosclerosis and risk for arrhythmias such as Long-QT-Syndrome.[1] Modifiable risks include factors that contribute to coronary vascular disease, such as hypertension, hyperlipidaemia, smoking and obesity.[1] It is noteworthy that approximately 15% of sudden cardiac deaths occur in those with structural heart disease, such as hypertrophic or dilated cardiomyopathies.[1] In the in-patient setting, cardiac arrests are a consequence of multi-organ disease and/or failure which leads to sudden cardiac arrest, compared to the out-of-hospital cardiac arrest (OHCA) patient that likely suffers a primary cardiac or cerebral event.[2] Respiratory disease and comorbidity is also a factor that distinguishes in-hospital cardiac arrest (IHCA) from OHCA, as patients are less likely to have hypoxic or hypercarbic sequelae in the acute out-of-hospital setting.[2] Patients in the in-hospital setting are also likely to suffer different dysrhythmias compared to those in the out-of-hospital setting, because of iatrogenic and drug-related causes of arrhythmia.[2]

In the United States of America (USA) the incidence of OHCA is reported at 95 per 100 000 population, with a prevalence of approximately 350 000 cases per year.[1, 3, 4, 5] In Europe the incidence of OHCA is reported as 86 per 100 000 population with a prevalence of 490 000 per year. [1, 5] Australia suffers a high reported incidence of OHCA at 113 per 100 000 per year.[5] There is a lack of clear information about incidence and prevalence in lower- and middle-income countries (LMICs), but an overall incidence estimation in Asia has been reported as 55 per 100 000 population.[5]

The prevalence and incidence of cardiac arrest varies between countries because of socioeconomic driven differences in lifestyle and access to health care, and shifting disease burdens.[6] LMICs have seen a shift in the disease burden away from infectious diseases and diseases that kill children and adolescents towards modifiable diseases, such as chronic lung disease, obesity, diabetes and cardiovascular disease, all of which are contributing to higher rates of cardiac arrest in these countries.[6] While LMICs have been preparing for the financial burden to fight infectious diseases, they were unprepared for the rise in modifiable and preventable diseases, and are struggling to keep up with the financial burden these new diseases bring.[6] According to the 2017 Institute for Health Metrics and Evaluation Global Burden of Disease data, approximately 76 670 people (140 per 100 000 deaths) in South Africa died of cardiovascular disease related conditions in 2017.[7] Cardiovascular deaths in 2005 account for approximately 13% of South African deaths compared to the 25 -34% described in Australia and Europe.[8]

The chain of survival:

Survival from cardiac arrest depends on many factors, the most important factor being time to cardio-pulmonary resuscitation (CPR).[1] The key predictors of survival from cardiac arrest are duration of arrest, primary rhythm, time to onset of CPR and defibrillation, initial rhythm and whether or not the arrest was primarily cardiac related.[2] The American Heart Association (AHA) has changed their treatment algorithms for cardiac arrest, following the publication of several studies that show that morbidity and mortality improvements are associated with high quality CPR and early defibrillation.[5] The AHA has developed an OHCA chain of survival encompassing steps that can improve the outcome of patients who suffer OHCA, with the aim to improve the neurologically intact survival of patients.[1, 3, 4] It is possible to have neurologically intact survival after any cardiac arrest if the steps of the chain of survival are executed correctly and timeously.[3]

The steps in the chain of survival consist of (i) early activation of emergency medical services (EMS) which includes effective communication between civilians and EMS; (ii) early, high quality CPR; (iii) early defibrillation; (iv) timeous transfer to hospital with appropriate life support measures and (iv) quality advanced life-support in-hospital with adequate post care following return of spontaneous circulation.[9] Two important steps rely on EMS activation and rapid transport. This is not as easily executed in LMICs as it is in higher income countries, as EMS services are either underdeveloped or absent.[10] Mould-Millman et al. previously studied the availability of EMS and the development of EMS systems in Africa, and found that EMS systems only existed in about a third of countries in Africa.[11] They also found that less than nine percent of Africans had access to EMS services, and these were often limited to BLS-services only.[11] In Lebanon, an upper middle-income country like South Africa, EMS systems consist entirely of volunteers and OHCA is usually only managed by rapid transfer to a hospital without prehospital implementation of CPR.[10] A study in Lebanon revealed that patients who suffered OHCA were more likely to have poor outcomes if transported by EMS as compared with private vehicles.[10] This is not a poor reflection on EMS per se, but rather an indication that the EMS system is underdeveloped and that there is a need for better EMS protocols. The resource limited Lebanese EMS system can take up to 25 minutes before responding to a cardiac arrest, and Sayed et al. showed that only 47% of OHCA patients get pre-hospital CPR.[10]

In South Africa, there is a median response time of nine minutes after an EMS call was placed notifying a cardiac arrest, due to several factors such as difficult scene access in informal developments and a very under-resourced EMS service, factors which caused a delay in execution of the chain of survival.[8] This study also found that the initial rhythm upon EMS arrival was non-shockable in 76% of presentations, of which asystole was 60%.[8] This is likely because of the longer response times before EMS can reach a patient in the field, and the lack of bystander CPR.

Another important step regarding the Chain of Survival is early defibrillation. This includes both EMS use and public use of automated external defibrillators (AEDs) to safely and adequately shock patients that have OHCA and a shockable rhythm. This requires that large amounts of AEDs should be available for the public to use, which remains a financial challenge in LMICs where health care systems are still battling the communicable disease burden.[12] In high-income settings, there has been a steady rise in survival rates following OHCA, mainly due to bystander CPR rates and public access to AEDs.[13]

Public access to AEDs have also contributed to improved survival from ventricular fibrillation associated cardiac arrest.[13] Studies that were done in Japan show that despite the increased number of AEDs available to the public, the overall rate of use remains low (835 out of more than a million

cardiac arrests in a ten-year period).[13] In South Africa defibrillator use appears to be low due to the long times it takes EMS to reach patients.[8]

Bystander CPR:

The most important first step in the management of cardiac arrest is layperson recognition that cardiac arrest has occurred and initiation of CPR.[5,14,15] This has important clinical application, as the chain of survival depends on the early administration of CPR and defibrillation.[14] In the out-of-hospital setting, this will rely on bystanders performing CPR until EMS arrives on scene. However, the overall rate of bystander CPR remains low and infrequent,[16] estimated to be approximately 30% of witnessed cardiac arrests in the USA.[17]. In the developed world, large strides are being made in survival from OHCA, due to the increased rates of bystander CPR.

Mouth-to-mouth CPR vs compression-only CPR:

The primary argument for compression-only CPR (COCPR) is that in the first four to six minutes after sudden cardiac arrest, the cerebral and myocardial tissues are the most sensitive to decreased blood flow, and COCPR maintains this blood flow.[5] Thereafter, as the functional residual capacity of the lungs loses its oxygen content, does it become more important to provide breaths and oxygen to the patient.[5] Many studies have reported that any interruptions in chest compressions, even when it is to provide ventilation to the patient, causes an acute drop in the coronary and cerebral perfusion pressures.[5] Another reason COCPR is being advocated, is that studies have suggested that ventilation may increase intra-thoracic pressure and hinder venous return to the heart, dropping preload and therefore cardiac output.[5] Placing an advanced airway often requires that CPR be stopped, and in itself can be harmful to the patient.[5] Studies have also shown that there is improved neurological intact survival with passive oxygenation during CPR using a non-rebreather face mask.[5]

By emphasizing cardiac compressions, there seems to be improved cardiocerebral perfusion, leading to improved neurological outcomes.[5] Compression first CPR is especially important in adults, as adults rarely arrest from a pulmonary/respiratory causes.[5] Together with this, laypersons are encouraged to start CPR on any patient that is unresponsive and not delay compression performing a pulse check.[5] The de-emphasis of rescue breaths also stems from the fact that a cardiac arrest, as long as it is from a non-respiratory cause, would not lead to decreased arterial oxygen partial pressures for a couple of minutes, even though the ideal timeframe is unknown.[5] If the airway is open, chest wall recoil from compressions will allow for passive ventilation down a diffusion gradient between the atmosphere and lungs.[5] Avoiding mouth-to-mouth ventilations and rescue breaths also protects laypersons from acquiring a communicable disease which can discourage laypersons from performing this skill.[5] Studies comparing compression-only CPR to conventional CPR have reported no worsened mortality nor morbidity, but both are improved compared to no CPR.[5] Studies have also shown that performing CPR prior to defibrillation can improve the first pass success rate of defibrillation, as substrate and oxygen becomes available and “primes” the heart to become ready for a perfusing rhythm after the shock is delivered.[5] It is postulated that bystander CPR may prolong a shockable rhythm such as ventricular fibrillation, leading to improved first pass shock success when these patients are defibrillated.[18]

It is based on these and other studies that the American Heart Association came up with the following recommendations and call to action:[19]

1. When an adult collapses, bystanders should, at a minimum, activate their local emergency medical services.
2. Untrained bystanders should provide hands-only CPR until an AED becomes available or EMS arrives on the scene.
3. Trained bystanders who are confident in their ability to provide rescue breathing with minimal interruptions in CPR, should provide conventional CPR (including mouth-to-mouth), but can also provide hands-only CPR. They must perform this until an AED becomes available, or EMS arrives on the scene.
4. If trained bystanders are not confident in their ability to perform rescue breathing or providing conventional CPR, they should give hands-only CPR until an AED becomes available or EMS arrives on scene.

Despite these recommendations having been made in 2008, it is unknown if this is widely taught in South Africa or if there is general awareness of these recommendations.

Rates and hesitancy:

In a study performed in Sweden, bystander CPR rates doubled between the early 1990s and early 2000s.[18] It is estimated that 25% of the population of Sweden is educated on performing CPR, which leads to increased bystander CPR rates and therefore their increased survival rate, albeit lack of improved long term neurological in-tact survival.[18] Takei et al. report that less than a third of bystanders would initiate bystander CPR without being prompted to do so.[15] Takahashi et al. showed that bystanders were unwilling to perform CPR in 30.9% of witnessed cardiac arrests.[14] Takei et al. revealed that bystander CPR was more likely to be performed when multiple bystanders were present, when the OHCA occurred in an urban setting, and when the average age of the bystanders were under the age of 65 years old.[15] Further delays in the initiation of bystander CPR are the lack of confidence, fear of legal implications and lack of knowledge on how to perform CPR by laypeople and bystanders.[14]

There has subsequently been a decrease in the emphasis on rescue breathing, airway management and drug delivery during CPR, especially in the field.[5] This is after research suggested that laypersons would be more willing to assist a stranger with CPR if the emphasis is placed on compressions and not on rescue breathing.[5] There is a large emphasis placed on compression only CPR, especially teaching this to laypersons who will better receive these simplified skills.[5] Since bystander CPR has been simplified to focus on compression only CPR, there has been a trend of increasing willingness to perform bystander CPR.[20]

Training:

Tanigawa et al. illustrated in his study that bystanders were more willing to start CPR on a witnessed arrest patient if they had received CPR training beforehand.[16] Their study concluded that bystanders were more willing to initiate CPR after dispatcher prompting if they had previous CPR training, as well as spontaneously initiate CPR in the case of witnessed arrest.[16] Their study also shows that those with CPR training had better overall AED knowledge and a better knowledge of where to find an AED in their community.[16] This study highlights the need for widespread CPR training to all members of the community.[16] There have been many attempts at improving bystander CPR rates, such as community programmes, hands-only CPR training and dispatcher CPR performance.[17]

In the USA, 20 states have legislated that high school learners can only graduate if they can perform CPR.[17] It is unknown if this teaching in schools translates into long-term knowledge, but some studies suggest that CPR teaching improves bystander CPR rates and knowledge at two-month follow-up.[17] It

has also been postulated that brief CPR instruction videos will have similar effects when shown to laypeople.[17] A recent study showed that, amongst high school learners, information retention and CPR quality was improved in those who watched a 90 second video illustrating CPR, compared to those who attended a 20-minute tutorial on hands-only CPR.[17] Many campaigns have been aimed at adjusting the attitude towards CPR amongst laypersons, by adjusting television campaigns, dispatcher assisted CPR campaigns, and by training specific target groups.[20] One study investigated the use of schoolchildren to become a "BLS-teacher" for relatives and parents.[20] In this study, they demonstrated that there was an improved attitude towards bystander CPR when the instructor was a child, making this a potential viable option for bystander CPR roll-out.[20] Training by children appeared to have a strong positive impact on the intention to perform CPR.[20]

Dispatcher assisted:

Previous simulation type studies have revealed that dispatcher instructed CPR can be as effective when performed by laypeople, as that performed by trained rescuers.[15] It is therefore of importance that any dispatcher that gets activated during an emergency realises that a cardiac arrest has occurred and encourages the caller (or other bystanders) to initiate CPR. Studies in Japan have shown that there has been an improvement in overall mortality once dispatcher have encouraged bystander to initiate CPR.[14] Simulation based studies however have shown that bystander-dispatcher interaction can lead to prolonged "hands-off" time and lack of CPR.[14] However, once dispatchers have realised that they were dealing with a cardiac arrest, EMS and hospital based systems were quicker to respond and therefore led to shorter chain of survival times.[14]

Takahasi et al. also showed that dispatchers may hinder the amount of "hands-on" time by questioning about circumstances and bystander psychological response to witnessing an OHCA.[14] It was estimated to take an average of 99 seconds to initiate CPR after dispatcher instructions.[14] It is therefore imperative that protocols are established for dispatchers that limit this delay in the initiation of CPR.[14] It has been proposed that dispatcher instructed bystander CPR may improve rates of bystander CPR, but it has also been postulated that such CPR may not be of high quality by a layperson and therefore of no utility to the patient's outcome.[15]

Survival rates following out-of-hospital cardiac arrest

Survival from OHCA will continue to increase as long as the chain of survival is executed correctly and continuously improved upon. Improvements that can be made includes more effective communication between civilians and EMS providers, dispatcher instructed CPR, performing bystander CPR, better in-field delivery of care, and quicker transfer to definitive care.[1]

Survival from cardiac arrest in the prehospital setting is approximately 6.4% (interquartile range of 3.7 to 10.3%) in the USA.[1] Survival rates from in-hospital cardiac arrest is estimated to be 15%.[21] Factors that affect survival in OHCA is initial rhythm, location, age, witnessed or not, bystander CPR, mode of arrest and time to arrival of rescue services.[21] It is important to remember that time of day and day of week are also important factors, especially while awaiting EMS services.[21] In Europe and the USA, survival rates range from 7.5 to 10.8%, but it estimated to be much lower in Asia, estimated at 5.4%.[22]

Mawani et al. found that <2% survived cardiac arrest from EC disposition and <1% survived to hospital discharge in Karachi, Pakistan.[12] They found that only 2.3% of OHCA had any bystander CPR intervention, even when there was dispatcher assisted CPR guidance.[12] This was despite 92% of these

arrest being witnessed.[12] A median time of 20 minutes for the start of CPR was found in this study.[12] There is thus a need for better community engagement and education about CPR.[12] A study about the factors that may influence bystanders to do CPR and the patient outcomes, performed in Japan, showed that only 2.7% of patients survived with a favourable neurological outcome.[15] Countries like Japan, Korea, Singapore and Taiwan have well equipped EMS systems and the chain of survival runs smoothly in these countries, but there is a pan-Asian lack of ALS services and lack of bystander CPR.[22]

In the developing world, it is not clear if resources should be spent on modifying ALS systems, or focus on increasing bystander CPR rates.[22] This study aimed at seeing how outcomes differ for each of these factors in the United Arab Emirates (UAE), Taiwan, Thailand, South Korea, Japan, Singapore and Malaysia.[22] In this study they found positive outcomes if CPR was initiated within 8 minutes of arrests, but that there was a poor outcome whenever advanced airways were placed or drugs were administered in the field.[22] In this study, bystander CPR rates varied from 10.6% in the UAE to 41.6% in Japan (mean rate 39.3% due to large Japanese cohort, average rate 26.6%).[22]

Very little is known about OHCA and their outcomes in South Africa or Africa as a whole.[8] Stein et al. aimed to see how South African statistics compared to similar studies done in the developed world, finding multiple differences.[8] There was a lack of data to conclude what the actual mortality rate was and how many patients survived neurologically intact.[8] This study found that of those patients with presumed cardiac cause for arrest, only 40% of cases had any sort of resuscitation performed, and only 14.5% received bystander CPR of the total number of arrests.[8]

It is difficult to conclude that the improvement in outcomes from OHCA is solely due to improvements in community led CPR initiations and AED use.[23] It is important to realise that some studies that are published and indicate improved survival from OHCA when layperson CPR was initiated, may be confounded by the fact that there was early dispatcher recognition of cardiac arrest, earlier deployment of EMS and therefore EMS interventions, early emergency department alert and activation of life-saving interventions that contributed to overall decreased mortality and improved neurological outcomes.[23]

Conclusion

Cardiac arrest is a significant public health burden, although the incidence of cardiac arrest varies between countries due to socioeconomic driven differences in lifestyle, access to health care, and shifting disease burdens. Survival from cardiac arrest depends on many factors, the most important factor being time to CPR. This involves early layperson recognition that cardiac arrest has occurred and immediate initiation of CPR, often by lay bystanders. The rate of bystander CPR remains low, but large strides are being made in improving survival from OHCA in high-income settings due to increasing rates of bystander CPR.

Although the value of early CPR in OHCA is well established, there is little published evidence on the factors affecting bystander CPR rates in South Africa and what baseline knowledge they have of CPR, if any. It is also unclear if South Africans are aware of compression-only CPR and whether they prefer this variant to the conventional mouth-to-mouth CPR variant. There is therefore an obvious need to understand what attitudes laypeople in South African communities have towards bystander CPR, and what fears they might have that prevent them from performing CPR, and how these fears can be mitigated. This will further inform CPR training and awareness programmes that aim to improve public capacity to respond effectively to OHCA and thereby improve outcomes from OHCA.

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Part B: Manuscript in Article Format

A description of the knowledge and attitudes towards bystander CPR amongst participants in a community outreach initiative in Cape Town

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Word count:

2932 words

Table and figure count:

Three tables

Two figures

Abstract:

Introduction: Mortality rates from out-of-hospital cardiac arrest can be reduced by early CPR. A better understanding of the factors that prevent or encourage bystander CPR will assist in tailoring CPR training by community organisations to meet the needs of the communities they serve. The aim of this study was, therefore, to describe the basic CPR knowledge and attitudes towards performing out-of-hospital CPR of laypersons who volunteer for Sisaphila community based CPR courses in Cape Town, South Africa.

Methods: Paper-based surveys were distributed at bystander CPR training events, prior to participants receiving free CPR training. Data captured included participant demographics, indications of prior CPR training, basic knowledge of CPR theory and their attitude towards compression-only versus conventional (mouth-to-mouth) CPR.

Results: Fifty one surveys were completed and captured. Ninety percent of participants were female, and 31% had previously received CPR training. Participants had a low level of baseline CPR knowledge, with only 20% of the participants able to correctly answer 3 out 5 basic questions about CPR. Participants were hesitant to perform CPR including mouth-to-mouth resuscitation on anybody other than a relative, but over a third (36%) were more willing to perform CPR on a family member, 58% were more willing to perform CPR on a friend or colleague, and 66% were more willing to perform CPR on a stranger if compression-only CPR was an option.

Conclusion: We found that South African laypersons have a low level of baseline knowledge of CPR and that they were more willing to perform CPR if hands-only CPR was an option over traditional CPR including mouth-to-mouth breathing, similar to International trends. Our study also indicates that there is a need to regularly retrain those individuals that have had prior CPR training. These findings can assist community based CPR training programmes in their curricular development.

Keywords:

CPR; bystander; hands-only; cardiac arrest

African relevance:

- Limited information is known about the perceptions of the South African population regarding CPR on bystanders at witnessed cardiac events
- This study provides evidence that South Africans may have similar hesitations to performing mouth-to-mouth CPR as Western populations as participants were more willing to perform CPR when compression-only CPR was provided as an option
- The findings of this study have value in informing community based CPR training programmes which are vital to improving bystander CPR rates.
- Improved bystander CPR rates are crucial to initiating the OHCA chain of survival and improving the outcome of OHCA patients in low resource settings where EMS systems are not well developed

Introduction:

Cardiac arrest is a common public health burden.[1] Out of hospital cardiac arrest (OHCA) has a global incidence of 50 to 60 per 100 000 population.[2] Despite improvements in global health care, the mortality rate for OHCA remains high.[1] McNally et al. reported a 10.8% OHCA survival rate in the United States,[3] compared to a 22.3% survival rate for in-hospital cardiac arrest as reported by the American Heart Association (AHA).[4] The best outcomes with cardiac arrest followed early defibrillation and early cardiopulmonary resuscitation (CPR).[1] This has led to deploying automated external defibrillator (AED) devices in many public spaces. However, not all facilities in low-resource settings have the resources to purchase and maintain AED's. Therefore, early initiated CPR is the only viable option to reduce mortality rates from OHCA in low-resourced settings.

There is a three to fourfold reduction in mortality when CPR is started at the time of cardiac arrest.[1,5] This observation led to an increase in American Heart Association outreach projects aimed at teaching laypersons CPR, something that remains costly to do in LMICs.[1]

Some studies suggest that laypersons in the United States and Japan are hesitant to perform CPR due to their unwillingness to perform mouth-to-mouth rescue breathing, with Lu et al. demonstrating in China that as little as 15% of university students would perform CPR because of this fear.[1,7,8] However, there have been improvements in the uptake of bystander CPR since the AHA changed their CPR algorithms in 2008 to avoid manually opening the airway and avoid mouth-to-mouth breathing by starting and continuing with chest compressions only.[1] These changes also make it easier for emergency medical service (EMS) dispatchers to telephonically guide the CPR procedure for bystanders who are not trained in performing basic life support (BLS) or CPR.[1,8] Hands only CPR has simplified the manner in which this skill can be taught to laypersons.[1] However, it is not known if South Africans are aware of the new AHA guidelines promoting compression-only CPR and whether this would affect their willingness to perform CPR if required.

Given the proven effectiveness of early cardiac compressions-only CPR in improving patient survival following OHCA, it is important to understand the factors that influence the laypersons' willingness to perform bystander CPR, and to recognise the contextual influence of economic, cultural and national factors.[5] It is also important to understand if laypersons trained in CPR will perform this procedure within their own communities if necessary.[9] However, little is known about the baseline CPR knowledge of laypersons in South Africa, and there is a paucity of published research on layperson attitudes towards bystander CPR. It is also not known if laypersons in South Africa are aware of the concept of compression-only CPR prior to training. Several community organizations, in low resource settings, such as Sisaphila in Cape Town, train layperson volunteers bystander CPR skills via dedicated training courses.

Sisaphila (www.facebook.com/SisaphilaCPR) is a not-for-profit community outreach program, supervised by the Divisions of Emergency Medicine of the University of Cape Town and Stellenbosch University, with assistance from the South African College of Emergency Care. It aims to create an awareness of CPR and educate laypersons on the technique of hands-only CPR in adults, children and infants, without offering accreditation in BLS.

A better understanding of the factors that prevent or encourage layperson volunteers to perform bystander CPR will help tailor the Sisaphila CPR training to better meet the needs of their communities. The aim of this study was, therefore, to describe the basic CPR knowledge and attitudes towards performing out-of-hospital CPR (comparing hands-only to conventional CPR) in their communities of laypersons who volunteer for Sisaphila community based CPR courses in Cape Town, South Africa.

Methodology:

Study design and setting

We performed a cross-sectional, descriptive study using a structured paper-based survey. We assessed the prevalence of prior CPR training, baseline CPR knowledge and the attitudes towards performing bystander CPR, within the participants of Sisaphila CPR-outreach activities in the City of Cape Town, South Africa. Sisaphila events are hosted in vulnerable and economically deprived communities, where access to health care is complicated by lack of transport, lack of funds to access health care and inaccessibility by EMS vehicles secondary to underdeveloped infrastructure. Sisaphila, with the help of other non-governmental and non-profit organizations who request CPR training, aims to train laypersons on hands-only CPR in adults, children and infants.

Survey development

We developed a simple survey in consultation with Sisaphila programme management based on a literature review, the information needs of the programme, the time available for survey deployment, and the anticipated educational background of the sample (Appendix 1). Surveys were translated and available to participants in English, Afrikaans and Xhosa.

The Health Research Ethics Committee of Stellenbosch University approved this study (Ref number 8405) (Appendix 5).

Data collection

We collected data at three consecutive Sisaphila outreach events held between March and May 2019 at various sites in Cape Town, South Africa. The March event was held in the coastal suburb of Fish Hoek, attended by youth leaders and volunteers who manage youth outreach activities in informal settlements, including health care workers who work as emergency medicine technicians and social workers. The April and May events were held in Khayelitsha, a large informal settlement, attended by carers and supervisors from several children's homes, and included some health care workers such as nurses and social workers. Prior to the commencement of CPR training, participants were voluntarily enrolled, after providing informed consent, into the study and completed the paper based survey assessing their level of prior training, knowledge of cardiopulmonary resuscitation and their attitudes towards performing bystander CPR.

Data analysis:

Completed surveys were electronically captured onto a Microsoft Excel spreadsheet. Demographic and descriptive data are presented as percentages, or means and standard deviations as appropriate. Data captured using Likert scales is presented as modes and interquartile ranges.

Results:

Fifty one surveys were distributed, completed and captured. The majority of participants were female (90%), and aged between 19 and 55 (Interquartile range: 27 to 43) years (Table 1). Just under a third of these participants indicated that they had previously undergone CPR training, the majority of which reported that they had completed First Aid Level 1 training. Over a third of the participants reported that they were currently or had previously worked as a healthcare worker. This included five home based carers, two nurses, one emergency medicine technician, one social worker, one general health

councillor, and a further nine who did not disclose the type of healthcare work they were doing/had done.

Table 1: Participant demographic details

	Previous CPR training (n=16)	No previous CPR training (n=35)	All (n=51)
Sex (% female)	88 (14)	91 (32)	90 (46)
Age (years; ± standard deviation)	29 ± 8	38 ± 10	35 ± 10
Highest level of education (% total)			
Less than Grade 12	25 (4)	49 (17)	41 (21)
Grade 12	31 (5)	20 (7)	24 (12)
Diploma or certificate	19 (3)	9 (3)	12 (6)
Degree	13 (2)	11 (4)	12 (6)
Postgraduate degree	6 (1)	3 (1)	4 (2)
Current or past healthcare worker (% total)	50 (8)	31 (11)	37 (19)

Values shown are percentages of total with n in parentheses, except for Age which is shown as mean ± standard deviation.

When asked why they had chosen to come for CPR training that day, participants commonly selected reasons that indicated a potential personal benefit to themselves such as that this skill would help them to do their job better, and that this skill would help them advance at their place of work (Table 2). The majority of participants also indicated the belief that everyone should know how to perform CPR as a reason for their attendance.

Table 2: Reasons for participant's attendance at CPR training event

Reason (% total)	Previous CPR training (n=16)	No previous CPR training (n=35)	All (n=51)
Do job better	63 (10)	74 (26)	71 (36)
Everyone should know CPR	81 (13)	57 (20)	65 (33)
Potential career advancement	44 (7)	71 (25)	63 (32)
Benefit as a volunteer	38 (6)	54 (19)	49 (25)
Encountered previous collapse	25 (4)	31 (11)	29 (15)
Other	0 (0)	6 (2)	4 (2)

Values shown are percentages of total with n in parentheses. Participants were able to select more than one option.

Basic CPR knowledge

Baseline CPR knowledge (prior to training) was poor in all participants. When participants were asked how confident they were (using a 5 point Likert scale) in identifying when someone needs CPR, only

thirteen (33%) were completely confident that they could identify a patient requiring CPR (mode 5, IQR 3-5). Four (8%) of the participants correctly stated what the CPR abbreviation stood for (Figure 1). Thirty four (67%) of the participants were able to correctly recall an emergency phone number. Interestingly, 71% of participants that had never had CPR training could recall an emergency number. A third (33%, n=17) of the participants knew where to correctly place their hands during CPR, 11 (22%) of the participants knew the correct compression rate, and only ten (20%) knew the correct compression depth. Only 10 (20%) participants could correctly answer three or more of the five questions above.

Of those who have previously indicated that they had CPR training, only two (13%) knew what CPR stood for, only six (38%) felt confident they knew when to perform CPR, and only four (25%) could recall correctly where to place one's hands and what rate and depth to compress during CPR.

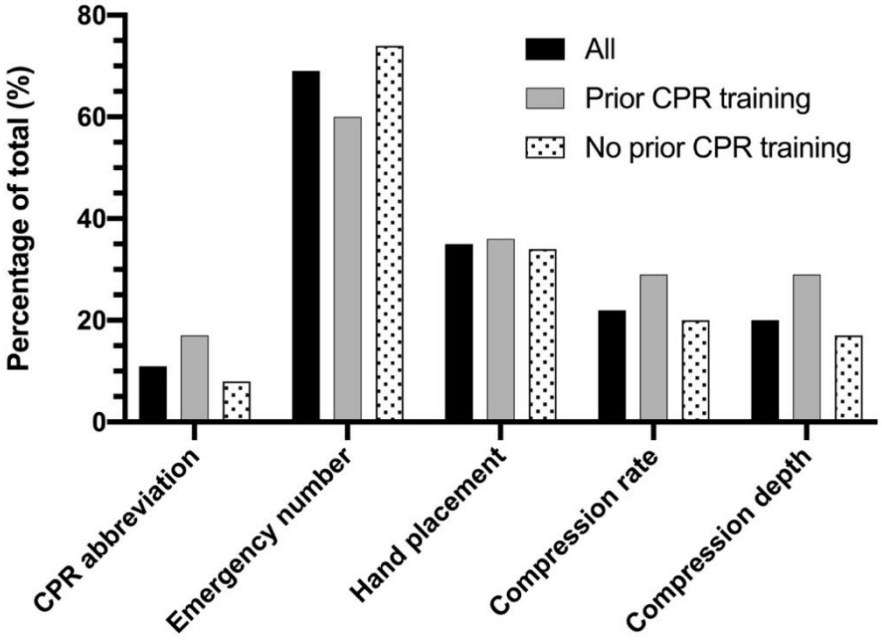

Figure 1: Percentage of total participants that could correctly recall each of the five knowledge components

Attitude towards performing CPR:

Eight of the participants (16%) indicated that they had previously encountered an emergency situation where a patient required CPR. Seven of the participants (14%), five of which had prior CPR training, reported that they had previously performed CPR on a patient.

Only one of the 51 participants indicated that they had a religious or cultural objection to performing CPR, but did not specify the objection, and the large majority of participants (89%) believed that all members of society should be able to perform CPR.

Using a 5 point Likert scale, most participants indicated that they would definitely perform mouth-to-mouth CPR on a family member if needed. They were less likely to perform mouth-to-mouth CPR on a friend or colleague and on strangers if needed (Table 3). In general, participants' willingness to perform CPR increased when asked specifically about hands-only CPR (Table 3). Of the total participants that completed both questions, 36% reported a higher likelihood of performing CPR on

family members if hands-only CPR was an option, with 58% and 66% reporting a higher likelihood of performing CPR on friends and colleagues, or strangers respectively when hands only CPR was an option.

Table 3: Reported likelihood of participants performing CPR when required

	Mouth-to-mouth CPR (mode, interquartile range)	Hands only CPR (mode, interquartile range)	Mean difference* (± standard deviation)	Number of participants with increased rating# (n)
Family member	5 (3-5)	5 (5-5)	0.7 ± 1.9	12 (33)
Friend or colleague	3 (2-4)	5 (3-5)	1.0 ± 1.7	18 (31)
Stranger	1 (1-4)	5 (3-5)	1.4 ± 2.1	21 (32)

Measured on a 5-point Likert scale where 1=unlikely and 5=definitely. Difference between hands-only CPR rating and mouth-to-mouth CPR rating. # Relative to mouth-to-mouth CPR. Number in parentheses is total number of participants that completed both questions.*

When considering CPR on a family member or close friend, the three most common reasons for choosing not to do CPR were fear of causing harm (67%), fear of doing it wrong (61%) and the presence of blood in the mouth (57%) (Figure 2). When considering CPR on a stranger, the most common reasons for choosing not to do CPR would be the presence of blood in the mouth (53%), fear of doing it wrong (49%), the fear of infection (45%) and feeling unsafe at the scene (45%).

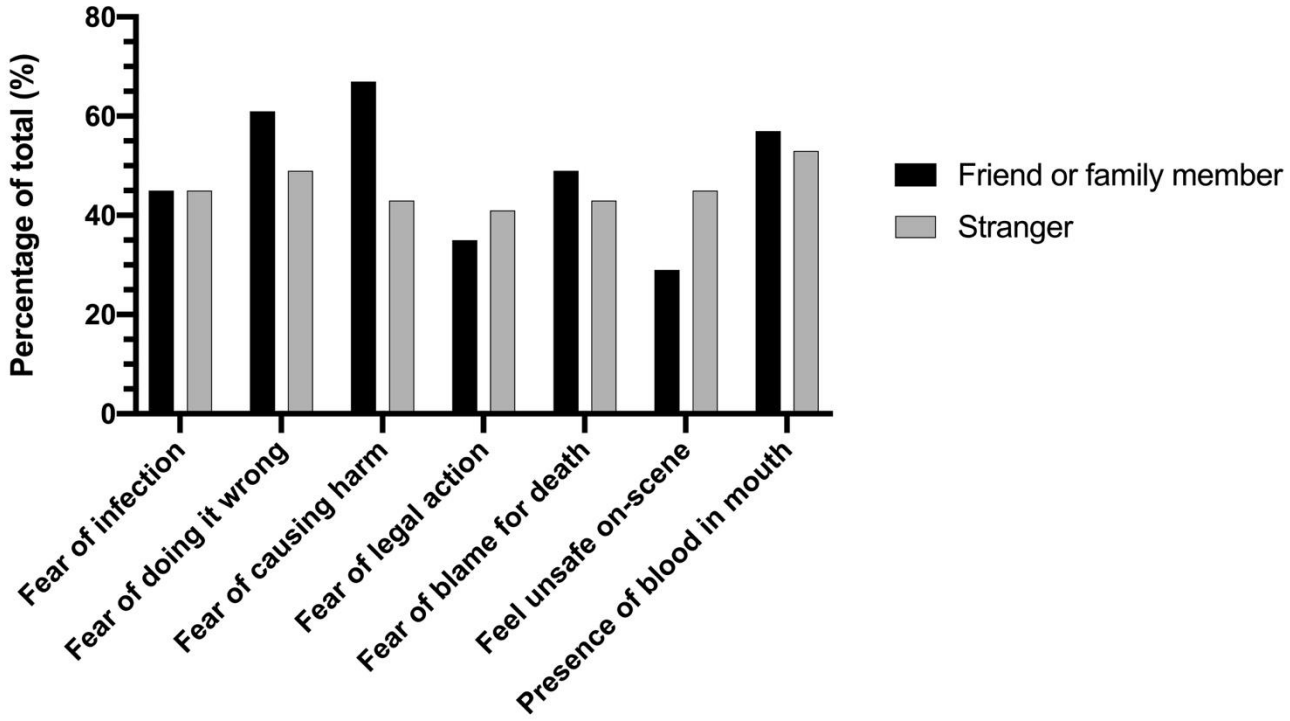

Figure 2: Reasons participants would choose not to perform CPR when required

Discussion:

The most important finding of this study was that participants were more willing to perform CPR if hands-only CPR was an option. In particular, over a third (36%) were more willing to perform CPR on a family member, 58% were more willing to perform CPR on a friend or colleague, and 66% were more willing to perform CPR on a stranger when hands-only CPR was an option. This finding supports international trends that favour hands-only CPR, and therefore the new AHA guidelines. Urban et al[1] showed in their study that less than a fifth of their participants were aware of compression only CPR, but that at least 75% of these participants will perform hands-only CPR on a stranger, if they were presented with this option. Although our survey did not seek to determine if participants knew that hands-only CPR was an option or not, we can assume that South Africans would be more willing to perform CPR if they could perform hands-only CPR, which is the primary teaching of Sisaphila, seeing as Sisaphila does not offer accreditation.

A common reason for not performing CPR amongst the participants in this study was the fear of infection or blood in the mouth. This is an interesting contrast to the work of Shibata[7] et al. who showed that most laypersons in Japan were more hesitant to perform CPR out of a concern for doing it incorrectly or because of a lack of knowledge. However, Shibata's study showed that both laypersons and medical staff were more willing to perform CPR on strangers if hands-only CPR was an option. This finding might be explained because South Africa has multiple campaigns focusing on HIV treatment and prevention, ultimately contributing to the awareness of communities and their hesitancy in performing mouth-to-mouth resuscitation.

It is interesting to note that 90% of the participants in this sample were female, and 45% of participants showed that feeling unsafe at the scene would affect their decision to perform CPR or not. Other common fears related to not performing CPR, were the fear of causing harm or performing it incorrectly, particularly in friends or family. This is an interesting contrast to the work of Bouland[10] et al. who found that laypersons were more willing to perform CPR on loved ones but withhold CPR from strangers because of the fear of doing it incorrectly. Bouland[10] also showed that despite compression-only CPR training, laypersons would still withhold CPR from strangers, citing fear of incorrect practice as a cause, suggesting that there might be additional concerns not addressed during training that prevent laypersons from performing compression-only CPR on strangers. Bouland[10] did however show that the rate of CPR increased in family members and loved-ones with compression-only CPR. It is therefore important for community training initiatives to emphasize the importance of compression only CPR on strangers, and that perhaps further research is necessary into additional factors that prevent laypersons in performing CPR. In addition, only 33% of the sample were confident, prior to their Sisaphila training, that they could identify someone in need of CPR. These findings emphasize the need for training programmes to specifically address these fears. Programmes should give clear guidance on identifying patients who need CPR, and discuss the risk associated with incorrect CPR to allay participants' fears.

Another observation is the low level of baseline knowledge of CPR in this group. Only 20% of the participants could correctly answer three out of five basic questions about CPR, despite the fact that a third had previously attended some level of CPR training. In addition, two thirds of the participants had no further formal education following completion of high school. This gives an indication of the low knowledge base which instructors can assume and also provides guidance on the appropriate level of complexity and language commensurate with a high-school level of education. It further emphasises the need for regular, repeated training, which should also be communicated to training participants. The low level of knowledge retention by those who had undergone CPR training further

highlights the need for regular repeated training, as knowledge retention is poor after just one training session.

It is clear from the findings of our study in comparison with that of Urban[1] et al. and Shibata[7] et al. that Sisaphila could have a very strong impact in the community it serves by promoting hands-only CPR, as it is likely to increase rates of participation by bystanders. It is also clear that the participants in this study have similar hesitancies towards mouth-to-mouth resuscitation and therefore promote the guidelines for teaching laypersons to perform compression-only CPR. The lack of baseline knowledge as evident by this survey shows a need for continuous teaching to promote the overall knowledge of CPR. By using these events as a platform for education, not only can CPR rates be increased, but it can be used to promote the compression-only CPR variant, and by teaching this method, laypersons from the community will not have to fear the risks of infections and blood exposure that prevent them from performing this skill on bystanders. As Mpotos[6] et al. mentioned in their study, teachers play an important role in the continuous education of CPR to schoolchildren. It may be of value to perform a similar study as ours amongst school teachers to see if it can replicate the results.

A heartening finding is that the vast majority of participants (89%) indicated that they thought everyone should be able to perform CPR. Although this was a small and very select sample, we also observed no evidence that religious or cultural objections play a role in hesitation to perform CPR in this population. It is however important to note that this sample was selected from participants who were attending free CPR training and that this finding is perhaps not representative of the general population.

The limitations of this study were that it was small and comprised of a group of participants who had voluntarily enrolled for a CPR training workshop and attended with the purpose of learning how to do CPR. Over a third of these participants had a history of some level of healthcare work. We therefore could not describe the reasons individuals would not wish to learn how to perform CPR, and we also acknowledge the limitation of generalising these findings to the general Cape Town population. However, the findings of this study are of value to community-based organisations, such as Sisaphila, in informing their programme strategy.

Conclusion:

The key findings from this study are that participants were more willing to perform CPR if hands-only CPR was an option, and that there is a low level of baseline knowledge on CPR in this population. This study could well improve the curriculum of Sisaphila and other community-based CPR initiatives, to ensure that adequate CPR knowledge and basic skills are disseminated to the volunteers who attend these workshops. Improving CPR training in low resource settings, where EMS systems are often poorly developed and access to immediate healthcare is limited by poor infrastructure is vital to achieving the OHCA chain of survival. These findings also highlight the role of education in addressing the fears that laypeople have about mouth-to-mouth CPR, and improving awareness of the compression-only variant of CPR, in keeping with the AHA guidelines on teaching laypersons CPR. Encouraging the involvement of schools and teachers may help to promote the dissemination of this skill to the community, destigmatise the fear of doing CPR incorrectly and increase the overall rate of CPR. Given the findings of this study, future work that investigates changes in attitudes with training, and evaluating knowledge retention with community-based training will be of value to practitioners in this field.

Dissemination of results:

Results of the above study were distributed via newsletter to the coordinators of the Sisaphila Community Outreach and have already informed changes in the training programme.

Authors' contribution:

Conceptualisation, design, data collection, statistical analysis, interpretation and drafting of manuscript primarily performed by HZ (60% effort). CS (30%) and HL (10%) supported with design, statistical analysis and critical review of manuscript. All authors approved final version for publication and agreed to be accountable for all aspects of the work.

Declaration of competing interest:

The authors declare no conflict of interest.

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Part C: Appendices

Appendix 1: Survey:

Please answer the questions below as accurately as possible.

About you:

Sex: Male ☐ Female ☐ I prefer not to say ☐

Age: _____

Highest level of education:

Less than Grade 12 ☐ Grade 12 certificate ☐ Diploma or Certificate ☐

Degree ☐ Post-graduate degree ☐

Have you ever worked in health care? Yes ☐ No ☐

If yes, please explain what type of health care work you have done:

_____

_____

Have you ever received CPR training before today? Yes ☐ No ☐

If yes, please explain what training you have received.

_____

Why have you decided to come for CPR training today (you may choose more than one answer)?

☐ Attending this training is compulsory for me

☐ This skill will help me perform my job better

☐ This skill will help me perform better in my volunteer activities

☐ This skill will help me advance at my place of work

☐ I previously witnessed someone collapse and wasn't sure what to do

☐ I believe everyone should know how to do CPR

☐ Other (please specify):

The following questions will help us understand what you know about CPR. If you do not know the answer, please say "I don't know" rather than guessing. We'll help you learn the rest after this survey.

What does CPR stand for?

_____

What telephone number would you phone in a medical emergency?

_____ I don't know ☐

On the following scale, indicate how confident you are that you will know when someone needs CPR?

(Unsure) 1-------2-------3-------4--------5 (Extremely sure)

Where should you place your hands during CPR?

☐ The lower half of the breastbone (Sternum)

☐ The upper half of the breastbone (Sternum)

☐ Just to the left of the breastbone (Sternum)

☐ Upper abdomen (stomach)

☐ I don't know

How many compressions should you perform during one minute of CPR?

80 – 100 ☐ 100 ☐ 100 – 120 ☐ >120 ☐

How deep should you compress the chest during CPR?

Less than 5cm ☐ More than 10cm ☐ A third of the depth of the chest ☐

The following questions will help us understand your attitude towards performing CPR.

Do you have any religious or cultural objection towards performing CPR?

No ☐ Yes ☐

If yes, and you are willing to share this with us, please specify: _____

_____

Have you ever been in an emergency situation where someone needed CPR?

Yes ☐ No ☐ I don't know ☐

Have you ever performed CPR in a medical emergency? Yes ☐ No ☐

How likely are you to perform CPR, including mouth-to-mouth breathing, if one of the following people needs it? Please circle the most appropriate answer.

A family member: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

A friend or colleague: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

A stranger: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

How likely are you to perform CPR on someone if it DOES NOT involve mouth-to-mouth breathing? (i.e. only performing compressions on the chest). Please circle the most appropriate number.

A family member: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

A friend or colleague: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

A stranger: (Unlikely) 1 ------- 2 ------- 3 ------- 4 ------- 5 (Definitely)

Which of the following would prevent you from doing CPR on a <u>family member or close friend</u>? You may choose more than one answer, and/or provide a different answer.

- ☐ Fear of infection
- ☐ Fear of doing it wrong
- ☐ Fear of causing more harm or hurting the patient
- ☐ Fear of legal action
- ☐ Fear of being blamed if they do not survive
- ☐ If you do not feel safe at the scene or in the situation
- ☐ Presence of blood in the mouth or on the patient
- ☐ I am unwilling to do mouth-to-mouth breathing
- ☐ Other (please specify)

_____

Which of the following would prevent you from doing CPR on a <u>complete stranger</u>? You may choose more than one answer, and/or provide a different answer.

- ☐ Fear of infection
- ☐ Fear of doing it wrong
- ☐ Fear of causing more harm or hurting the patient
- ☐ Fear of legal action
- ☐ Fear of being blamed if they do not survive
- ☐ If you do not feel safe at the scene or in the situation
- ☐ Presence of blood in the mouth or on the patient
- ☐ I am unwilling to do mouth-to-mouth breathing
- ☐ Other (please specify)

_____

Do you think CPR is a skill that every person should be able to perform?

Yes □ No □ Unsure □

Thank you for contributing to our survey. Your responses are greatly appreciated.

Appendix 2: Informed Consent Form

A description of the knowledge of and attitudes towards bystander CPR amongst participants in a community outreach initiative in Cape Town.

Information and consent form

We are conducting a research study at today's Sisaphila CPR workshop. The purpose of this research study is to assess the underlying knowledge people who are not medically trained have about CPR and to describe their access to CPR training. We would like to establish if there is a need for more CPR training in communities, and how people feel about performing CPR. We would like to invite you to take part in this study. Your participation in this research study will not affect today's Sisaphila CPR workshop and you will receive the training regardless if you complete the survey or not. Your participation is completely voluntary and you may choose to not participate. You can also withdraw from the study, without consequence or penalty, at any time. If you feel that the survey is traumatizing, please feel free to inform the investigator or the coordinator of the event, and we will assist you by helping you with the arrangement of counselling services.

If you decide to participate, we will ask you to complete a paper survey that will take you about 10 minutes to complete. Your responses will be anonymous and confidential. Apart from your name and signature on this consent form, we do not collect any personal information that can be used to identify you in the survey. Therefore, there is no risk that you will be identified from your answers given in the survey.

This study will help us to understand why some people choose to perform CPR on someone, and why others do not. This will allow us to change our CPR training and improve CPR teaching programmes.

This research is being conducted by Dr Heinri Zaayman, as part of his Masters of Medicine degree. The study has been approved by the Health Research Ethics Committee of the Stellenbosch University. If you have any questions about the survey, please feel free to contact Dr Zaayman at 073 303 3524. You may also contact the Stellenbosch University Health Research Ethics Committee at 021 938 9677.

I, ……., have been informed about the study described above and voluntarily agree to participate in this study. The investigators have answered my questions and provided me with a copy of this information sheet.

_____ _____

Signature of participant Date

_____ _____

Signature of investigator Date

Appendix 3: Protocol as approved by ethics committee:

A description of the knowledge of and attitudes towards bystander CPR amongst participants in a community outreach initiative in Cape Town.

Proposal for a study in partial fulfilment of the MMed degree.

Principal investigator (MMed candidate):

Dr Heinri Zaayman

Division of Emergency Medicine

University of Stellenbosch

Supervisors:

Dr Heinrich Lamprecht

Division of Emergency Medicine

University of Stellenbosch

Dr Colleen Saunders

Division of Emergency Medicine

University of Cape Town

Purpose of this study:

Out of hospital cardiac arrest is a large public health burden worldwide. The earlier CPR is commenced, the better the rate of survival. This relies on the general public to initiate CPR on patients. However, little is known about the baseline CPR knowledge of laypersons in South Africa, and there is a paucity of published research on layperson attitudes towards bystander CPR in South Africa. Several community organizations, such as Sisaphila, have outreach activities in which they teach laypersons this skill. A better understanding of the factors that prevent or encourage laypersons to perform bystander CPR will assist in tailoring this CPR training to better meet the needs of the community and improve the rate of bystander CPR.

Introduction:

Cardiac arrest is a common public health burden.[1] Out of hospital cardiac arrest (OHCA) has a global incidence of 50 to 60 per 100 000 population.[2] Approximately 80% of these OHCA are related to cardiovascular disease.[3] As public health efforts have targeted the communicable disease burden, especially in lower and middle income countries, there has been a shift from communicable disease related death towards non-communicable disease.[3] Therefore public health systems must focus their efforts on preparedness for cardiac arrest, especially considering the rise in cardiovascular disease prevalence.[3]

Despite improvements in health care, the mortality rate for out of hospital cardiac arrest remains high.[1] McNally et al report a 10.8% OHCA survival rate in the United States,[4] compared to a 22.3% survival rate for in-hospital cardiac arrest as reported by the American Heart Association.[5] The best outcomes with cardiac arrest are reported following early defibrillation and early cardiopulmonary resuscitation (CPR).[1] This has led to the deployment of automated external defibrillator (AED) devices in many public spaces such as airports and shopping malls. It is important, however to realize that not all facilities in low-resource settings have the funds to purchase and maintain AED's in large public spaces. Therefore, early initiated CPR is still critical in reducing mortality rates from OHCA.

There is a three to four fold reduction in mortality when CPR is started at the time of collapse, as reported by Kanstad et al and Urban et al in Norway and the United States respectively.[1,6] This has led to an increase in American Heart Association outreach projects aimed at teaching laypersons CPR.[1] This is however a costly undertaking and logistics make it hard to reach a large audience of laypersons.[1] In Europe, the European Resuscitation Council recommends that schoolchildren be taught CPR, but this has not been formally enrolled into the school curriculum.[7]

Research by Urban et al has suggested that laypersons in the Unites States are hesitant to perform CPR due to their uneasiness with performing mouth-to-mouth breathing, with Shibata et al finding similar trends in Japan.[1,8] Lu et al found that as little as 15% of bystanders are willing to perform CPR for this reason in a study amongst University students in China.[9] Since the American Heart Association changed their algorithms to start with chest compressions and not opening the airway, there have been improvements in bystander CPR rates.[1] Algorithms have been further simplified to specify hands-only CPR, which involves only chest compressions and no mouth-to-mouth breathing.[1] This makes it easier for emergency medical services (EMS) dispatchers to telephonically explain CPR to bystanders and other laypersons who are not trained in performing basic life support (BLS) or CPR.[1,9] Hands only CPR has simplified the manner in which this skill can be taught to laypersons.[1]

Given the effectiveness of hands only CPR in improving patient outcome following OHCA, it is important to understand the factors that influence the laypersons' willingness to perform bystander CPR, and to recognise cultural and national differences in these factors.[6] It is also important to

understand if laypersons who are trained in CPR are willing to perform this skill in an out of hospital emergency. [10] However, little is known about the baseline CPR knowledge of laypersons in South Africa, and there is a paucity of published research on layperson attitudes towards bystander CPR in South Africa. Several community organizations, such as Sisaphila, have outreach activities in which they teach laypersons this skill. A better understanding of the factors that prevent or encourage laypersons to perform bystander CPR will assist in tailoring this CPR training to better meet the needs of the community.

Aim and objectives:

The study aims to describe: the level of knowledge of cardiopulmonary resuscitation (CPR) and the attitudes towards performing bystander CPR among participants of the Sisaphila community outreach initiatives in the City of Cape Town.

In order to achieve this aim, the specific objectives of this study are:

- Determine the proportion of participants in the Sisaphila community outreach initiatives that previously had CPR training.
- Determine their baseline CPR knowledge.
- Determine their attitude towards performing CPR in different scenarios.
- Determine the factors that contribute for the same cohort to seek CPR training.

Methodology:

Study design and setting:

This will be a cross-sectional, descriptive study to assess the prevalence of CPR training, and the attitudes towards performing bystander CPR, within the participants of Sisaphila outreach activities in the City of Cape Town using a structured paper based survey. Sisaphila is a community outreach project that seeks to educate at-risk communities and other laypersons on the skill of bystander CPR. For more information regarding Sisaphila, please see www.facebook.com/sisaphilacpr .

Characteristics of study population:

Sisaphila has several outreach activities per year that target other community organizations and their staff members, allowing for a heterogeneous study population across gender, ethnicity, socio-economic status and education level. Sisaphila outreach activities target non-governmental organisations (NGOs), such as women's shelters, children's homes, home based care organizations, and other community upliftment programs including youth leadership organisations and foster-parent support groups, where hands-only CPR is taught to staff and the constituents of these organizations. These outreach activities are held all across Cape Town, including both disadvantaged and advantaged communities.

In addition, Sisaphila organises two flagship outreach activities per year. The first being on Mandela day in July, where emergency medicine registrars teach CPR to family, friends and other relatives in emergency centre waiting rooms. The second is held during national CPR week in the first week of November at public venues (such as the Sea Point promenade or V&A waterfront) and is aimed at

increasing awareness and CPR training in the general public. To address the aim of this study, participants will be recruited from the flagship event held during national CPR week in November 2018. This study population is diverse in terms of their background, ethnicity, level of education and socio-economic status. Participants will however not be recruited from any hospital based events.

Recruitment and enrolment:

Sisaphila outreach activities target a group of approximately 20-50 persons per event. When these events are arranged, the coordinator at the organization will be made aware that there is an ongoing study and will be allowed to inform the group ahead of time.

During the event, an explanation of the study will be given by the conductor of the CPR training and the consent forms will be distributed (Appendix 1). The study and consent procedure will also be explained verbally, and participants will be given an opportunity to ask questions about the study. Participants will be free to choose not to participate in the study, and will still receive the CPR training as planned, regardless if they participated in the study or not.

Participants that consent to taking part in the study will be provided with the study survey form, and will be allowed to complete the survey anonymously.

Data collection methods:

Paper based surveys will be conducted at Sisaphila outreach events. Consenting participants will be asked complete the two page survey (Appendix 2) prior to CPR training commencement. Anonymised survey data will be captured into an Excel spreadsheet.

Data safety and monitoring:

All Sisaphila outreaches are led by an Emergency Medicine Registrar, including the principal investigator, and they act as instructors for the event. The principal investigator will collect and safely store the hard-copy survey and informed consent forms in an access controlled, securely locked office. As the surveys are anonymous, confidentiality will not be breached.

The electronic Excel spreadsheet containing captured survey data will be stored under password protection on the principal investigators computer, and will be appropriately backed up to minimise the risk of data loss.

Following completion of the study, the surveys and informed consent forms will be securely stored in the offices of the Division of Emergency

Data analysis:

The hand completed survey results will be electronically captured on a Microsoft Excel® spreadsheet for processing. Demographic and descriptive data, including nominal categorical data, will be expressed as percentages, or means and standard deviations as appropriate.

Ordinal categorical data from Likert scales will be presented as medians and interquartile ranges. Differences between participants who have previously received CPR training and those who have not will be assessed using the Chi-squared test, or the Fisher's exact test as appropriate. A p-value of less than 0.05 will be considered statistically significant

Ethical considerations:

Description of risks and benefits:

This is a low risk study and there is no risk of exploiting the vulnerability associated with this study population.

It is possible that potential participants may feel that they will not receive CPR training if they decide not to participate. There will be no coercion to participate and those who do not partake in this survey will not be discriminated against or not receive the scheduled CPR training that follows completion of the surveys. Organizers and potential participants will be made aware before-hand that there is an ongoing study that is voluntary and non-compulsory and that it will not affect their participation in the CPR training. The actual Sisaphila event will take place regardless of the amount of participation and completed surveys.

The organizer of the event and principal investigator will ensure that the completed surveys and informed consent documents remain safe and confidential. The informed consent form will be collected separately from the completed surveys, to allow for anonymity. The actual survey, even though it collects demographic data, will remain anonymous as no names or dates of birth are collected on the survey.

There is a small risk that participants may have previously experienced an incident of collapse requiring CPR and may find completing the survey or CPR training traumatising. If a participant has ever performed CPR and finds the event and/or study traumatizing, the principal investigator will ensure that appropriate counselling services are made available to the involved participant. As the study sample is made up of individuals who have volunteered to take part in the CPR training, it is unlikely that this will be case.

The findings from this study will aid in understanding laypersons' knowledge of CPR, thereby aiding attempts to better train them in future and to be prepared for sudden cardiac arrests and CPR. The information gathered will also aid in understanding what barriers exist in performing bystander CPR, so that solutions can be sought and implemented to overcome these barriers. The community in itself will benefit by being taught how to correctly perform hands-only CPR by a trained medical professional.

Informed consent process:

At the start of the Sisaphila events, a verbal explanation of the study will be given, and written consent will be sought from all participants. Participants will be given the opportunity to read through the information and consent form, ask questions and then sign it if they agree to participate in the study. The survey will not require the patients name or surname or any other identifying features, other than demographic details. The informed consent form and survey will be made available in Afrikaans, English and Xhosa.

Privacy and confidentiality:

Informed consent will be distributed to the potential participants, following which time will be allowed for questions, should any arise. These informed consent forms will then be collected separately, so that the surveys and informed consent cannot be linked to the same participant. Surveys will be collected by the coordinator of the Sisaphila outreach event without collecting the names or details of any of the participants of the study. The coordinator and principal investigator will then take every possible step to ensure that these completed surveys and consent forms remain confidential and are kept in a safe location. The survey data will be captured anonymously to a Microsoft ® Excel spreadsheet for processing. The survey data will be kept in a safe place and not shared with anyone outside of the research team.

Reimbursement for participants:

There will not be reimbursement for study participants. This is a low-risk study that does not place any additional inconvenience on the study participants. Sisaphila is a community outreach project that offers free CPR training to laypersons, and all the participants at the outreach events will receive CPR training regardless of whether they participated in the study or not.

Limitations:

As the participants are volunteers that are seeking CPR training and knowledge, the findings will not necessarily be applicable to the general public. However, since there are no previous studies on the knowledge of laypersons in the South African context, a better understanding of the attitudes associated with CPR will be established and CPR training programmes will be able to use this data to better tailor their future CPR training programmes.

Dissemination of findings plan:

The study findings will be shared with the supervisors of the Sisaphila outreach programme. The study findings will be written up in a dissertation in fulfilment of the requirements for the MMed degree. The final paper will be submitted for publication in a medical journals for scholarly and research purposes.

In addition, we anticipate that the findings will also be presented as a poster at the research day at the University of Stellenbosch, and be submitted for presentation at the annual EMSSA conference.

Project timeline:

EMDRC approval – 2 months

University of Stellenbosch Ethics approval – 2 months

Data collection from events – 6 months

Data analysis - 2 months

Write up and conclusion – 3 months

Resource utilization:

Sisaphila will be the centre of the data collection, and formal approval will be sought from the organization to collect data from the events. Tentative approval has been obtained pending ethical approval of the study. The events that they hold allow for data collection without altering their work. Paper and pens will need to be purchased for the study and completion of surveys and consent. Also fuel will need to be taken into account as events are located all over the greater Cape Town and require travel to these events for the completion of surveys.

Budget:

The study will be self-funded. Sisaphila will continue to carry the cost of actual outreach events. The following will need to be taken into account for the study to be self-funded:

Expense	**Approximate amount**
Petrol re-imbursement for coordinators	R50 per coordinator per event
Pens for completion of surveys and consent	R100
Printing of consent forms and surveys	R250
Translation cost	R5000
TOTAL:	**Approximately R5600**

References:

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4. McNally B, Robb R, Mehta M. Out-of-hospital cardiac arrest surveillance – Cardiac Arrest Registry to Enhance Survival (CARES). MMWR Surveil Sum. 2011: 60 (8): p 1 – 19
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7. Mpotos N, Vekeman E, Monsieurs K, Derese A, Valcke M. Knowledge and willingness to teach cardiopulmonary resuscitation: A survey amongst 4273 teachers. Resus. 2013; 84: p496 – 500.
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10. Axelson A, Thorén A, Holmberg S, Herlitz J. Attitudes of trained Swedish lay rescuers towards CPR performance in an emergency. Resus. 2000; 44: p 27 – 36.

Appendix 4: Plagiarism declaration for study proposal

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jou kennisvennoot • your knowledge partner

Plagiaatverklaring / Plagiarism *Declaration*

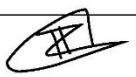
1 Plagiaat is die oorneem en gebruik van die idees, materiaal en ander intellektuele eiendom van ander persone asof dit jou eie werk is.
Plagiarism is the use of ideas, material and other intellectual property of another's work and to present is as my own.

2 Ek erken dat die pleeg van plagiaat 'n strafbare oortreding is aangesien dit 'n vorm van diefstal is.
I agree that plagiarism is a punishable offence because it constitutes theft.

3 Ek verstaan ook dat direkte vertalings plagiaat is.
I also understand that direct translations are plagiarism.

4 Dienooreenkomstig is alle aanhalings en bydraes vanuit enige bron (ingesluit die internet) volledig verwys (erken). Ek erken dat die woordelikse aanhaal van teks sonder aanhalingstekens (selfs al word die bron volledig erken) plagiaat is.
Accordingly all quotations and contributions from any source whatsoever (including the internet) have been cited fully. I understand that the reproduction of text without quotation marks (even when the source is cited) is plagiarism.

5 Ek verklaar dat die werk in hierdie skryfstuk vervat my eie oorspronklike werk is en dat ek dit nie vantevore in die geheel of gedeeltelik ingehandig het vir bepunting in hierdie module/werkstuk of 'n ander module/werkstuk nie.
I declare that the work contained in this assignment is my original work and that I have not previously (in its entirety or in part) submitted it for grading in this module/assignment or another module/assignment.

15064212 **Studentenommer / *Student number***	 **Handtekening / *Signature***
H Zaayman **Voorletters en van / *Initials and surname***	2020/09/09 **Datum / *Date***

Appendix 5: Letter of approval from ethics committee

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Health Research Ethics Committee (HREC)

Approval Notice

New Application

22/11/2018

Project ID :8405

HREC Reference # S18/09/196

Title: The knowledge of and attitude towards bystander CPR amongst a community outreach initiative in Cape Town

Dear Dr Heinri Zaayman

The **New Application** received on 08/10/2018 04:09 was reviewed by members of **Health Research Ethics Committee** via **expedited** review procedures on 22/11/2018 and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **This project has approval for 12 months from the date of this letter.**

Please remember to use your project ID (8405)on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Translation of the informed consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Please note you can submit your progress report through the online ethics application process, available at: Links Application Form Direct Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/healthresearchethics) for guidance on how to submit a progress report.

The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Departement of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website https://applyethics.sun.ac.za/ProjectView/Index/8405

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Mrs. Melody Shana ,

Coordinator

HREC1,

National Health Research Ethics Council (NHREC) Registration Number:

REC-130408-012 (HREC1)•REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372

Page 1 of 2

Appendix 6: Guidelines for authors for submission to African Journal of Emergency Medicine

This manuscript was prepared in accordance with the guidelines for authors submitting original articles to the African Journal of Emergency Medicine available here:

https://www.elsevier.com/journals/african-journal-of-emergency-medicine/2211-419x/guide-for-authors